

WHAT IS CLAIMED IS:

1. A method of operating a compression ignition engine comprising:
processing certain data to select one of plural fueling modes for operating the engine, and
 - a) when the result of the processing selects a first fueling mode, fueling the engine during an engine cycle to create a substantially homogeneous air-fuel charge within one or more combustion chambers and compressing the charge to auto-ignition without introducing any additional fuel after auto-ignition, and
 - b) when the result of the processing selects a second fueling mode, fueling the engine during an engine cycle to create a substantially homogeneous air-fuel charge within the one or more combustion chambers, compressing the charge to auto-ignition, and introducing more fuel after auto-ignition to provide additional combustion.
2. A method as set forth in Claim 1 wherein the step of processing certain data to select one of plural fueling modes for operating the engine comprises
processing data indicative of engine load.
3. A method as set forth in Claim 2 wherein the step of processing certain data to select one of plural fueling modes for operating the engine comprises

processing data indicative of engine speed.

4. A method as set forth in Claim 1 wherein in a graph of engine speed vs. engine load whose origin corresponds to zero speed and zero load, step a) occurs at engine speeds and loads within a first zone of the graph that bounds the origin, and step b) occurs at engine speeds and loads within a second zone that bounds the first zone.

5. A method as set forth in Claim 1 wherein the step b) comprises providing a dwell between the step of fueling the engine to create a substantially homogeneous air-fuel charge and the step of introducing more fuel after auto-ignition of that charge.

6. A method as set forth in Claim 1 wherein in the second fueling mode, the step of fueling the engine to create a substantially homogeneous air-fuel charge and the step of introducing more fuel both comprise injecting fuel by a fuel injection system, with the injection pressure that creates a substantially homogeneous air-fuel charge being at least as great as the injection pressure that introduces more fuel.

7. A compression ignition engine comprising:

a control system for processing data;

one or more combustion chambers; and

a fueling system for injecting fuel into the one or more combustion chambers;

wherein the control system controls the fueling system using a result of the processing of certain data by the

control system to select one of plural fueling modes for operating the engine such that a) when the result of the processing selects a first fueling mode, the engine is fueled during an engine cycle to create a substantially homogeneous air-fuel charge within one or more combustion chambers that is compressed to auto-ignition, with no more fuel being introduced after auto-ignition., and b) when the result of the processing selects a second fueling mode, the engine is fueled during an engine cycle to create a substantially homogeneous air-fuel charge within the one or more combustion chambers that is compressed to auto-ignition, after which more fuel is introduced to provide additional combustion.

8. An engine as set forth in Claim 7 wherein the certain data comprises data indicative of engine load.

9. An engine as set forth in Claim 8 wherein the certain data comprises data indicative of engine speed.

10. An engine as set forth in Claim 7 wherein in a graph of engine speed vs. engine load whose origin corresponds to zero speed and zero load, the first fueling mode occurs at engine speeds and loads within a first zone of the graph that bounds the origin, and the second fueling mode occurs at engine speeds and loads within a second zone that bounds the first zone.

11. An engine as set forth in Claim 7 wherein in the second fueling mode, the control system provides a dwell between the creation of a substantially homogeneous combustible charge within the one or more combustion chambers and the injection of more fuel into the one or more combustion chambers.

12. An engine as set forth in Claim 7 wherein in the second fueling mode, fuel is introduced by fuel injection both before and after auto-ignition, with injection pressure before auto-ignition being at least as great as injection pressure after auto-ignition.

13. A method of operating a compression ignition engine that comprises performing the following steps in succession during an engine cycle:

- a) injecting diesel fuel into a combustion chamber during a compression phase of the cycle to create a substantially homogeneous combustible charge;
- b) compressing the charge to a pressure at which the charge will auto-ignite; and
- c) injecting more diesel fuel into the combustion chamber after auto-ignition of the charge to provide additional combustion.

14. A method as set forth in Claim 13 comprising providing a dwell in the injection of diesel fuel between step b) and step c).

15. A method as set forth in Claim 13 wherein step b) comprises injecting more diesel fuel to cause additional combustion by conventional diesel combustion.

16. A method as set forth in Claim 13 wherein the pressure at which fuel is injected during step a) is at least as great as the pressure at which fuel is injected during step c).

17. A compression ignition engine comprising:

- a control system for processing data;
- a combustion chamber; and
- a fueling system for injecting diesel fuel into the combustion chamber;

wherein the control system controls the fueling system's injection of diesel fuel into the combustion chamber during a compression phase of each of successive engine cycles a) to cause creation of a substantially homogeneous combustible charge and compression of the charge to a pressure at which the charge will auto-ignite, and b) then to cause the injection of more diesel fuel into the combustion chamber to provide additional combustion.

18. An engine as set forth in Claim 17 wherein the control system causes a dwell in the injection of fuel between auto-ignition of the charge, and the injection of more diesel fuel.

19. An engine as set forth in Claim 17 wherein the injection of more diesel fuel causes additional combustion by conventional diesel combustion.

20. An engine as set forth in Claim 17 wherein the pressure at which fuel is injected before auto-ignition is at least as great as that at which fuel is injected after auto-ignition.